Abstract Title Page
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Title:

Patterns of achievement gaps among school districts: New data, new measures, new insights

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Abstract Body

Limit 4 pages single-spaced.

Background / Context:

Description of prior research and its intellectual context.

There are nearly 14,000 school districts in the United States. Of these districts, we have very little information about the size of academic achievement gaps between whites and blacks and white and Hispanic students. Up to now, data at the district level comes from two sources. The National Assessment of Educational Progress (NAEP) provides district level representation via the Trial Urban District Assessment (TUDA), but these data are available for fewer than 20 districts. An alternative source comes from state educational accounting offices but these data have been available only on an idiosyncratic state-to-state basis (available depending on whether and how states make data available).

What we know so far is that achievement gaps vary dramatically across districts. The white-black test score gap among students in the Washington, DC public schools is over two standard deviations (59 points on the NAEP math test). In Detroit, the gap is less than one-tenth of a standard deviation (2 points on NAEP), about 1/30th the size of the gap in DC.[1] What are we to make of this dramatic difference in achievement gaps? More importantly, what might we do—in our schools and in broader society—about it?

Purpose / Objective / Research Question / Focus of Study:

Description of the focus of the research.

We are interested in district-level achievement patterns across the almost 14,000 school districts in the country. We focus on districts as the salient level of analysis both because districts differ dramatically in their socioeconomic and demographic characteristics (Reardon, Yun and Eitle 1999; Stroub and Richards 2013), and because districts have considerable influence over instructional and organizational practices that may affect academic achievement gaps: including teacher hiring, evaluation, and placement decisions, professional development opportunities, student assignment and desegregation efforts, the allocation of resources among schools, and the type and availability of specialized instructional programs (Whitehurst, Chingos and Gallaher 2013). Nonetheless, we have relatively little rigorous large-scale research describing the variation in achievement gaps across districts or assessing the causes of these differences.

We conceptualize achievement gaps as the products of both out-of-school socioeconomic factors and malleable district policies and practices. Consequently, our analysis will estimate the extent to which differences between districts in achievement gap patterns can be accounted for by the different socioeconomic circumstances of children, and what proportion of the variation between districts might better be explained with school district policy features.

[1] Black 4th-grade students' mean 2009 math NAEP scores in Detroit and Washington, DC were 198 and 211, respectively; White students' scores were 200 and 270. The national standard deviation of 4th grade math scores was 29 points (U.S. Department of Education 2009).

Population / Participants / Subjects:
Description of the participants in the study: who, how many, key features, or characteristics.

We have estimated achievement gaps for districts housing nearly the entire black and Hispanic populations in the United States. We have estimated white-black gaps in 2,840 districts and Hispanic-white gaps in 3,415; these districts house 89% and 88% of the black and Hispanic student populations, respectively. The number of districts for which we have estimated gaps can be seen visually in Figures 1 and 2.

(please insert Figure 1 here)
(please insert Figure 2 here)

Research Design:
Description of the research design.

Under the No Child Left Behind legislation, all school districts are required to report the proportions of their students falling into one of several ordered proficiency categories (e.g., "below basic," "basic," "proficient," advanced"). Although test score data of this form are, in principle, publicly available for every school and district in the country, the coarse, categorical nature of the data and differences in the tests and proficiency category definitions across states, grades, and years seem to render meaningful comparisons impossible (Ho 2008; Ho 2009; Ho and Haertel 2006; Ho and Reardon, 2012). In earlier work, Ho and Reardon (2012) developed and validated a set of statistical methods for estimating average achievement and achievement gaps from these seemingly intractable data. These methods and their extensions enable us to do several things compute achievement gaps within each district in a metric that is comparable across states, grades, and years, even when different tests are used.

Data Collection and Analysis:
Description of the methods for collecting and analyzing data.

The US Department of Education has provided us with a unique data set that contains the counts of students scoring in each of their state's proficiency categories. The data set includes these counts for every district in the country, by grade (grades 3-8), year (from the 2008-09 through 2010-11 school years), test subject (math and reading), and student ethnic group. To date, such data have been available only on an idiosyncratic state-to-state basis (available depending on whether and how states make data available).

We will use the methods developed by Ho and Reardon (2012) above to construct a district-year-grade-subject-subgroup data set that includes an achievement gap interpretable as a quasi-effect size. This dataset will be unprecedented in its ability to describe patterns of achievement gaps across school districts.

In total, we have estimated 161,530 white-black and white-Hispanic achievement gaps, in math and reading, grades 3-8, and years 2009-2011. The breakdown of these gap estimates are shown in Table 1.

(insert Table 1 here)

From these data we will describe levels, trends and variation in racial achievement gaps. Models will be fit using precision-weighted random coefficient techniques, weighting each gap estimate by the inverse of its sampling variance and allowing the intercepts, annual trends, math-reading differences, and grade slopes to vary across districts. The full model is:

$$\hat{G}_{dygs} = \gamma_{0d} + \gamma_{1d} year_{dygs} + \gamma_{2d} grade_{dygs} + \gamma_{3d} math_{dygs} + e_{dygs} + \varepsilon_{dygs}$$

$$e_{dygs} \sim N[0, \sigma^2]$$

$$\varepsilon_{dygs} \sim N\left[0, \omega^2_{dygs}\right] = N\left[0, var\left(\hat{G}_{dygs}\right)\right]$$

$$\begin{bmatrix} \gamma_{0d} \\ \gamma_{1d} \\ \gamma_{2d} \\ \gamma_{3d} \end{bmatrix} \sim N\left[\begin{pmatrix} \gamma_0 \\ \gamma_1 \\ \gamma_2 \\ \gamma_3 \end{pmatrix}, \begin{pmatrix} \tau_{00} & \tau_{01} & \tau_{02} & \tau_{03} \\ \tau_{10} & \tau_{11} & \tau_{12} & \tau_{13} \\ \tau_{20} & \tau_{21} & \tau_{22} & \tau_{23} \\ \tau_{30} & \tau_{31} & \tau_{32} & \tau_{33} \end{pmatrix}\right]$$

The outcome variable $\hat{G}$ corresponds to the achievement gap in district *d*, year *y*, grade *g*, and subject *s*. These gaps vary by year, grade and subject. The coefficient γ_0 indicates the average achievement gap (neither subject- nor test-specific) in grade 5.5 (the middle grade for our data) in 2010 (the middle year for our data). Similarly, γ_1 represents the average achievement gap trend and γ_2 is the average rate at which the gaps change as cohorts progress through school. In addition to these average effects, the variance components τ_{00}, τ_{11}, τ_{22}, and τ_{33} indicate the variances of the gap sizes, cohort trends, and grade trends, and math differences, respectively, among districts. In addition to these parameters, the model also yields estimates of the reliabilities with which we can estimate district-specific gap levels and trends, and provides Empirical Bayes (EB) estimates of the district-specific levels and trends.

In addition to describing this variation, we wish to know whether differences in gaps between places like Detroit and Washington D.C. can be attributed to differences in ethnic composition, various economic and demographic variables, as well as information related to school district quality—such as per-pupil spending, school-level segregation, etc. To answer this, we will include in the models two sets of variables: one set of demographic and socioeconomic variables constructed from the American Community Survey; and one set of school policy variables, constructed from various sources such as the Common Core of Data, the F-33 School District Finance Survey, a data set describing which districts have desegregation orders, and data on charter school enrollments.

Findings / Results:

We have preliminary results describing district-level gap levels and variation. Results from the model described above can be found in Table 2.

(insert Table 2 about here)

We see that the average 2010 white-Hispanic gap is 0.495 SD and the average white-black gap is 0.618 SD. These gaps appear to be narrowing slowly across grades, by about 0.005 SD per grade. Across the three years for which we have data, white-Hispanic gaps have

narrowed slowly; there is no change for white-black gaps. Math gaps are smaller for white-Hispanic students and larger for white-black students.

The size of the variation across districts is quite large. For white-Hispanic gaps, 95% of districts have achievement gaps ranging between 0.06 and 0.93 SD For white-black gaps, there is also considerable variation, with 95% of districts having gaps ranging between 0.20 to 1.04 SD. Moreover, the variation of the intercept terms are very reliably estimated, with reliabilities of 0.924 and 0.933, respectively. Variation in rates of gap change across grades is also large, nearly ten times larger than the average magnitude.

Conclusions:

Description of conclusions, recommendations, and limitations based on findings.

We find considerable variation in the level of white-Hispanic and white-black achievement gaps across districts in the United States. In the following months, we hope to explain this variation by including a number of district-level control variables. We suspect a great deal of this variation can be explained by demographic composition variables. The hope is that some of the residual variation can then be explained by researchers investigating the efficacy of school district policies geared towards equity.

Appendices

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Appendix A. References

References are to be in APA version 6 format.

References

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Appendix B. Tables and Figures

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Figure 1

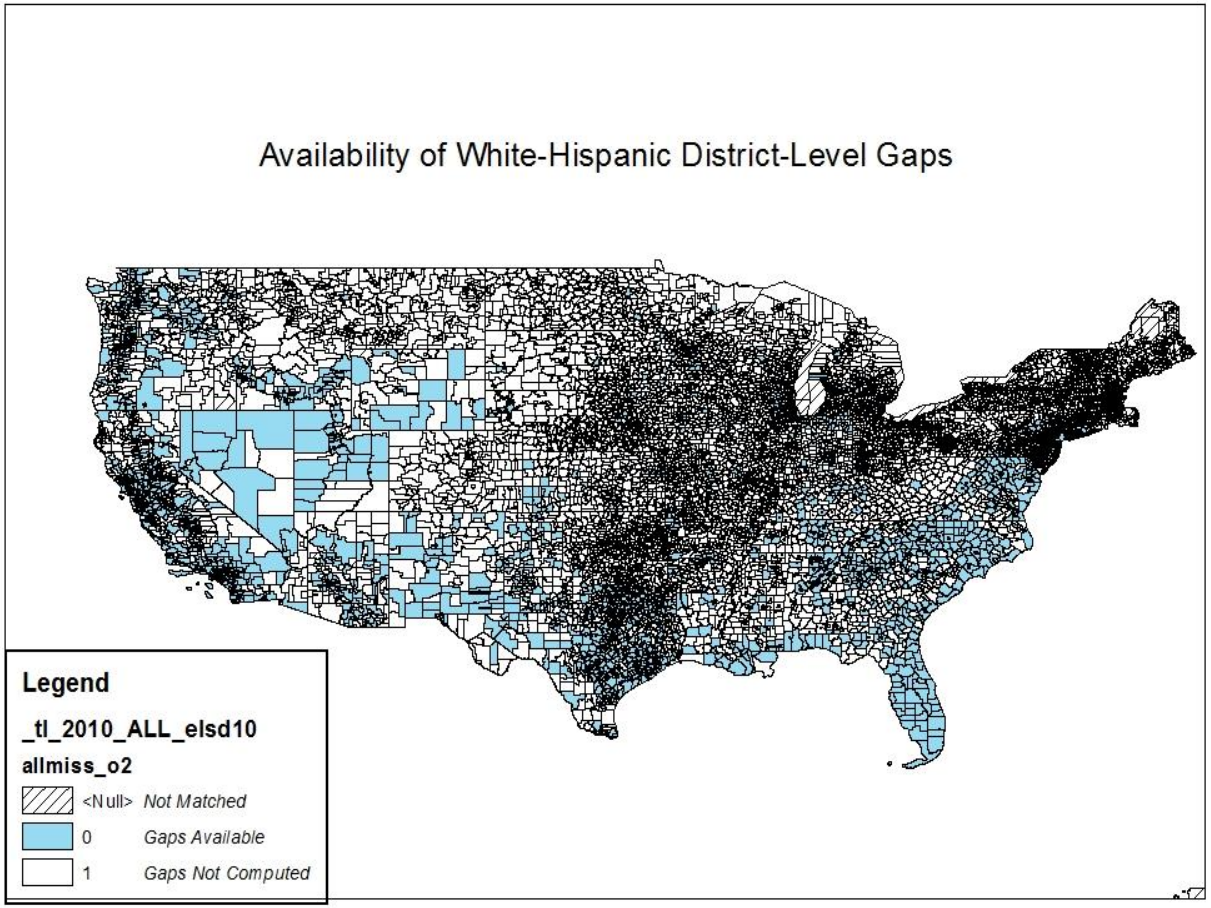
Availability of White-Hispanic District-Level Gaps
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Figure 2

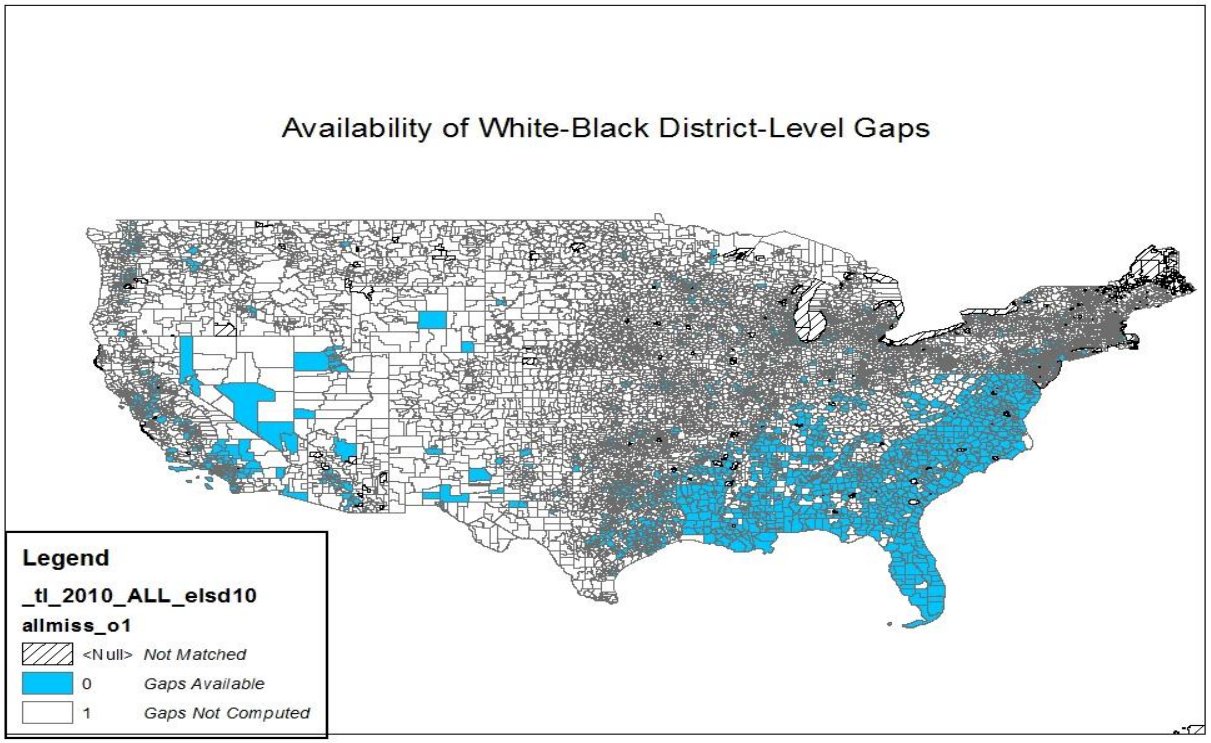
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Table 1: Number of Achievement Gaps Estimated, for each District and Subject

Grade	White-Black			White-Hispanic		
	2008-2009	2009-2010	2010-2011	2008-2009	2009-2010	2010-2011
3	4,189	4,355	4,087	4,760	4,966	5,211
4	4,176	4,347	4,098	4,594	4,858	5,099
5	4,152	4,331	4,042	4,600	4,753	4,935
6	4,176	4,331	4,153	4,550	4,762	4,966
7	4,230	4,369	4,135	4,473	4,713	4,925
8	4,152	4,268	4,084	4,365	4,570	4,755

Table 2: Levels, Trends and Variation: White-Hispanic and White-Black Achievement Gaps, District Level, 2009-2011, Grades 3-8

	White-Hispanic		White-Black	
Intercept (2010)	0.495	***	0.618	***
	(0.004)		(0.004)	
Grade	-0.005	***	-0.004	***
	(0.001)		(0.001)	
Year	-0.017	***	-0.001	
	(0.001)		(0.001)	
Math	-0.053	***	0.059	***
	(0.002)		(0.002)	
Variance				
sd(Intercept)	0.224		0.216	
sd(Grade)	0.036		0.03	
sd(Year)	0.042		0.035	
sd(Math)	0.103		0.094	
Reliabilites				
Intercept	0.924		0.933	
Grade	0.689		0.658	
Year	0.493		0.439	
Math	0.653		0.645	
Num. Dist	3415		2840	

Note: Grade centered at 5.5, Year centered at 2010, Math centered at 0.5